THE TELEGRAPHIC JOURNAL.

Vol. II.—No. 43.

NEW ZEALAND TELEGRAPHY.

Reports are periodically received in this country from New Zealand of the condition of telegraphy in that portion of the Empire. An independence of action and an original mode of procedure in the administrative and commercial direction of the business are evidenced, which are watched with lively interest. Uniform success and constant progress seem the text of each report. That for the year 1873-74 is no exception.

The revenue was estimated at £45,000, but it has exceeded that amount by nearly £2000.

On the 1st November, 1873, the tariff for private messages was reduced to 1s. for ten words, and 1d. for every additional word,—address and signature, up to ten words, being transmitted free of charge. At the same time, the Press rates between 8 a.m. and 5 p.m. were made one-half the private rate, the charge after 5 p.m. being reduced to 6d. for the first twenty-five words, and 3d. for every additional twenty-five. As the alterations in the Press rates involved an advance on the former day rates, provision was made in the new tariff to enable evening papers to receive during the day two hundred words of interprovincial news at evening rates; and also to receive, on the arrival of an English or Australian mail, an additional two hundred words of either or both at the same rates.

As a consequence of this great reduction, the number of Press telegrams sent during the year exceeded that of the previous year by some 17,000, or an increase of over 50 per cent; while the cash receipts for them were nearly £600 less than the corresponding receipts of the previous year. In other words, during 1872-73, 32,323 Press telegrams were forwarded, at a cost of £4601 11s. 6d.; while in 1873-74, 49,125 Press telegrams were forwarded, at a cost of £4066 1s. 1d.

During the year, 752,899 telegrams of all codes were transmitted, being an increase of 183,939, or more than 24 per cent over 1872-73.

The number of Money Order telegrams sent during the year was 8001, representing a value of £38,052 14s. 9d., or an increase of 2210 messages, and of £9945 18s. 1d., as compared with the previous year. The commission collected by the Post-Office was £1035; and after deducting £400 1s., due to the Telegraph Department as fees on the telegrams, there remained to the credit of the Post-Office, as commission on exchange, £634 19s., or more than 1⅔ per cent on the amount transmitted. Dunedin, Wellington, and Christchurch, and their respective sub-offices, issued the largest number of orders; and the same offices paid the largest number, except that Auckland and its sub-offices stand second in that respect.

The length of line maintained was 2530 miles, at a cost of £6 3s. 11d. per mile. During the year twelve new offices were opened.

The total earnings of the Department for the year were £59,875 0s. 11d., which, deducting the cost of the Signals Department and maintenance of lines, leaves £6026 6s. as interest upon the capital expended, £249,594 12s. 9d. This result is highly satisfactory, when it is remembered that it has been secured after reductions in the tariff, as before stated.

The number of telegrams transmitted during the year (752,899), compared with the number of interprovincial letters posted during the year, shows that 23·45 telegrams were sent for every 100 letters posted. In some provinces 28 telegrams have been sent for every 100 letters posted. The population on the 30th June amounted in round numbers to 300,000, so that the total number of telegrams during the year is somewhat in excess of an average of 2½ per head.

At the close of the year 2530 miles of line, carrying 5182 miles of wire, were in circuit. It is contemplated to make, during the present year, large additions to this mileage, which is rendered necessary by the still increasing business of the Department.

The following extracts read quaintly to home ears:—"In February, one of the turrets for carrying the wires across the Thames was accidentally burned down. A turret to supply its place is now nearly completed." "The clearing of a track to facilitate the examination of the line between Waitakaruru and Piako has been let by contract, and is rapidly approaching completion."

Duplex telegraphy has, through the skill and perseverance of Mr. C. Lemon, been successfully adopted, though no details of the system used have been given in the Report. It is said to have saved the costly necessity of laying a second cable across Cook's Strait, and to differ, in some important details, from all arrangements for a similar purpose yet worked out in Europe or America. We shall be glad to learn more of this antipodean novelty. Mr. Lemon has received the thanks of the Government of the Colony.

THE TELEGRAPHS OF QUEENSLAND.

We have lately received a copy of the report submitted by Mr. Cracknell, the Superintendent of Telegraphs in Queensland, upon the condition of his department during the year ending 13th June, 1874, accompanied by a carefully executed skeleton map of the circuits now at work, as well as of the lines in course of construction, in that colony.

The first line erected in Queensland, that from Brisbane to Ipswich, twenty-five miles in length, was opened for the despatch of public business on the 13th of April, 1861. Since that date rapid progress has been made, and when this report was issued there were in all 3203 miles of line, carrying 3931 miles of wire; seventy-four stations had been opened, and the entire system was managed with a staff of 181 members. The subjoined table is interesting, and shows the advance which year by year has taken place. (See next page).

The lines are principally built with ironbark, bloodwood, box, cypress, pine, and gum; occasionally iron poles have been employed in neighbourhoods where thunderstorms are rife, so as to guard against the ravages of atmospheric electricity. They are reported to have worked, "on the whole, well" throughout the year; the only serious difficulties that had to be encountered were the damages wrought by storms and bush fires.

Year.	Miles of Line.	Miles of wire.	No. of Stations	No. of Officers.	Total Number of Messages Transmitted.	Gross Receipts Cash.			"O.H.M.S." Business.			Approximate of Free Business, Shipping, &c.			Gross Expenditure.			Population.
						£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	
1861	169½	169½	7	13	5,678	938	14	9	122	12	2	—			1,652	5	6	34.367
1862	169½	169½	7	18	16,833	3,724	10	0	701	12	10	—			3,560	13	4	45,077
1863	221	221	8	21	19,219	4,152	1	10	945	6	8	—			5,662	13	0	61,640
1864	298	298	11	25	27,246	5,713	3	10	1405	5	7	—			6,604	12	1	74,036
1865	1042	1131½	25	52	47,697	10,343	9	5	3039	2	5	—			12.226	14	11	87.775
1866	1476	1565	33	66	55,610	11,120	4	3	4158	10	5	—			14,001	1	1	96,172
1867	1663	1752¼	33	66	56,143	10,985	2	6	4459	3	8	—			15,382	6	11	99.849
1868	1722	1811¼	35	69	59.632	11,256	7	1	5791	0	2	—			15,601	9	5	107.427
1869	2039	2182½	41	74	70,112	11,634	19	10	6776	11	7	—			16,100	12	8	109,897
1870	2132	2221¼	43	78	81,483	11,774	16	8	5424	6	6	9000	0	0	17,121	9	9	115.567
1871	2525	2614¼	51	91	82,630	11,691	12	10	3956	2	6	9000	0	0	19,073	17	11	125.146
1872	2818	3368	59	122	121,998	18,794	7	3	5094	11	11	9000	0	0	24,081	3	9	133.553
1873	3059½	3609½	73	150	156,268	20,759	1	3	6386	12	0	9000	0	0	27,776	8	5	146.690

The Morse instrument, in closed circuit, is universally employed, even at the stations upon the railway from Brisbane to Tornormba, which is under the supervision of the Department. It is said to work well, although it is a question whether the single needle in its improved form, which experience upon the English railways has proved to be so well adapted for the purpose, would not do better. The difficulties in the matter of adjustment must necessarily be considerable unless some mode of double-circuit working is made use of. Upon one circuit, Bowen to Kimberley, 619 miles in length, there are no fewer than twelve instruments.

Arrangements are being made for the purpose of forming a school in connection with the central office at Brisbane, at which the telegraphists may be trained previous to entering the service of the department. The qualifications required of them are, that "they must be between fifteen and twenty-four years of age, in a perfect state of health, capable of writing a clear, legible hand, of composing and spelling correctly, and well grounded in geography, grammar, and arithmetic." In addition to the ordinary mechanical requirements of sending and receiving which every telegraphist must possess, the Department has very wisely determined to include in the course of instruction "sufficient technical training to enable the candidate to detect and remedy ordinary faults both in the offices and on the lines," and to subject every candidate to an examination in this before he receives an appointment. That every telegraphist should possess this knowledge is important; it becomes doubly important in a country like Queensland, where the offices are so widely apart, and the means of travelling so limited. We are not aware whether the home department now insists upon this, but, if not, they might certainly do worse than take this leaf from the book of the Queensland Department.

The offices are divided into three classes with regard to the distribution of staff—those at which there are both operators and line repairers, those at which the line repairer is in charge, and those at which the operator is in charge. The staff of the central office at Brisbane numbers twenty, and is made up of a station-master, eight operators, three clerks, one line repairer, and seven messengers. On the subject of staff Mr. Cracknell says:—"I would take this opportunity of again drawing attention to the inefficient working of those offices where the duties of telegraph station-master and postmaster are combined. In my report dated 1st May, 1867, I pointed out that it would be injudicious to amalgamate the offices in question, and if persisted in would result in disappointment and failure. Subsequent experience has strengthened this belief, and I have no hesitation in recommending that they should again be placed under separate management and control."

We cannot well see to what this inefficient working can be due. No one could be expected to undertake either the postal or the telegraph duties of any office without a special training in each branch, and for some time after two services like this are amalgamated complaints and unsatisfactory working must occasionally be looked for. The telegraphists in England are now under the postmasters, but the latter, we should imagine, as a rule, know comparatively little of the details of telegraph work. They would rather leave it to the clerks in charge, who came over from the old telegraph companies. Yet, now that the two services are under the same management, we should be inclined to think that every effort will be made to assimilate them as far as possible, and throw open the prizes in the department, such as the appointments to postmasterships and the like, equally to the telegraphist and the postal clerk.

On the 1st of November, last year, the charges were reduced, and the uniform tariff was adopted of "one shilling for ten words, exclusive of address and signature, with one penny for each additional word; press messages not to exceed half rates." The inter-colonial rates were likewise lowered. To New South Wales the tariff is two shillings for ten words, and twopence for every additional word; to Victoria and South Australia, three shillings for ten words, and threepence for each additional word, with the exception of messages to stations on the Port Darwin line, for which much higher rates are demanded. The effect of this reduction was that the traffic for the first six months increased 65 per cent, although there was a falling off in the gross receipts of about 10 per cent, which, however, will doubtless soon be compensated for by the constantly increasing business. From Brisbane, and the other principal stations in the colony, the numbers are more than double what they were under the old tariff; at the smaller stations they remain about the same.

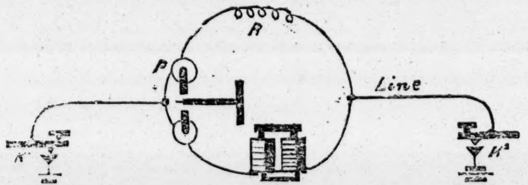
The expenditure for the year was £630 15s. 2d. in excess of the revenue, which includes the value of the Government messages passing over the wires. But in addition to these there is a large number of messages which are not charged, and which are not included in the revenue. Not only is shipping intelligence from stations within the colony, as well as from Sydney, Melbourne, and Adelaide, regularly transmitted and posted for the public information, but meteorological observations also are taken daily at several of the stations, transmitted to Brisbane, and posted at the central office; the rainfall is likewise registered by all the station-masters at nine every morning, and sent along with wind and weather reports to Brisbane and all the principal stations free of charge.

We are rather surprised to learn that for the twelve months ending 31st of December last, only 340 international messages were dealt with at all the stations in Queensland. This is accounted for by the almost prohibitory tariff which is in force for these, a message of twenty words from Brisbane to London costing no less than £9 16s. 6d. It is not, therefore, to be wondered at that efforts are being made to break down the existing monopoly, and negotiations are now in progress for the purpose of establishing a second and independent line from Australia to Europe. The route suggested is *via* Kimberley, at the south of the Gulf of Carpentaria to Singapore—Sumatra and Java being thus avoided altogether. English telegraphists would be employed throughout. The proposal has already received the sanction of the Parliaments of New South Wales, New Zealand, and Queensland; and a guarantee of 5 per cent per annum on the cost of constructing the lines has been promised by them. There is nothing, therefore, now to stand in the way, and this important work, the immediate effect of which will be to reduce the cost of a telegram betwixt the United Kingdom and our Australian Colonies by at least £3 7s 5d., will, Mr. Cracknell assures us at the close of his report, be commenced without delay.

ON A NEW METHOD OF WORKING POLARISED RELAYS.

By T. A. EDISON.

By means of the arrangement shown in the accompanying diagram any number of polarised relays may be worked in closed or permanent circuits.



P is an ordinary Siemens polarised relay. The main-line wire is attached to that connecting the two coils together. M is an electro-magnet, having a resistance equal to that of the relay P. R is a resistance equal to M.

When both keys are closed, and the current is made permanent, the tongue of the polarised relay will remain on either side, as the main-line current passes through the two coils in opposite directions, and produce no magnetism. But the electro-magnet M not being so balanced, becomes magnetic. If the circuit be interrupted, by opening either key, the secondary inductive current—from the latter circulating within the closed circuit of low resistance, formed by P, R, and M—acts upon the two spools of the polarised relay, and the tongue is thrown to one side. If the circuit is now closed, an inductive current from M passes through the circuit in the opposite direction, and the tongue is thrown to the other side. The armature of M is permanently attached to its poles to increase the strength of the inductive currents.

When once the main current is balanced within the coils of the relay P, by the coils R, no further adjustment is ever required.

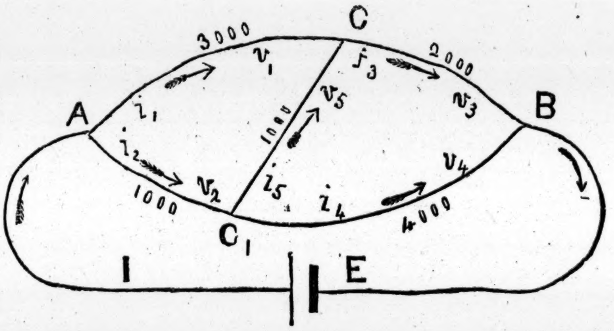
Newark, N.J., U.S.A., October 16, 1874.

COMBINED RESISTANCES.

By H. R. KEMPE.

The following problem was propounded in a recent number of the *Journal of the Telegraph*. A solution of it may prove interesting to our readers.

"Two wires between stations A and B are crossed. The resistance of the first wire between A and the cross is 3000 ohms, and between the cross and B 2000. The resistance of the second wire between A and the cross is 1000 ohms, and between the cross and B 4000. If the resistance of the cross itself is 1000 ohms, what is the combined resistance of the wires between A and B?'



Let A C B, A C_1 B be the two wires crossing one another at the points C, C_1. Let C, C_1 be the resistance of the cross.

Let us suppose an electromotive force, E, to be joined between the points A and B. Calling r_1, r_2, r_3, r_4, and r_5 the respective resistances of the different parts of the combination; i_1, i_2, i_3, i_4, i_5 the respective current intensities in those wires; also I the current intensity in the battery circuit; then, by Kirchoff's laws, we get the following six independent equations.

For the currents approaching and receding at A—

$$(1) \qquad I - i_1 - i_2 = 0.$$

For the currents approaching and receding at C—

$$(2) \qquad i_1 + i_5 - i_3 = 0.$$

For the currents approaching and receding at C_1—

$$(3) \qquad i_2 - i_4 - i_5 = 0.$$

For the currents circulating in the loop A C B E—

$$(4) \qquad i_1 r_1 + i_3 r_3 - E = 0.$$

For the currents circulating in the triangle A C C_1—

$$(5) \qquad i_1 r_1 - i_5 r_5 - i_2 r_2 = 0.$$

And, lastly, for the currents circulating in the triangle B C C_1—

$$(6) \qquad i_3 r_3 - i_4 r_4 + i_5 r_5 = 0.$$

If we call R the resistance between the points A and B, we shall then have—

$$I = \frac{E}{R}.$$

This equation, then, we have to obtain. To do this, first find the value of i_1 from equation (1), and substitute its value in the other equations, whereby we get rid of i_1; again, in like manner, find the value of i_2 from say equation (3), and substitute throughout; we shall thus get rid of i_2, and so on. As it will be unnecessary to show all these substitutions, we shall confine ourselves to one or two; thus—

$$(1) \quad I - i_1 - i_2 = 0, \text{ therefore } i_1 = I - i_2,$$

therefore we get—

$$(2) \quad I - i_2 + i_5 - i_3 = 0.$$
$$(3) \quad i_2 - i_5 - i_4 = 0.$$
$$(4) \quad I r_1 - i_2 r_1 + i_3 r_3 - E = 0.$$
$$(5) \quad I r_1 - i_2 r_1 - i_5 r_5 - i_2 r_2 = 0.$$
$$(6) \quad i_3 r_3 - i_4 r_4 + i_5 r_5 = 0.$$

By continuing this process we at length get—

$$(5) \quad I r_1 - i_5 r_1 - i_5 r_5 - i_5 r_2 - (r_1 + r_2) \times \times \frac{I (r_1 + r_3) - i_5 r_1 - E}{(r_1 + r_3)} = 0.$$

$$6) \quad I r_3 + i_5 r_5 - (r_3 + r_4) \frac{I (r_1 + r_3) - i_5 r_1 - E}{(r_1 + r)_3} = 0.$$

Therefore—

$$(5) \quad i_5 (r_1 r_3 + r_1 r_5 + r_3 r_5 + r_2 r_3) = -I (r_1 r_2 + r_2 r_3) - -E (r_1 + r_2).$$

$$(6) \quad i_5 (r_1 r_3 + r_1 r_5 + r_3 r_5 + r_1 r_4) = I (r_1 r_4 + r_3 r_4) + +E (r_3 + r_4).$$

By dividing the one equation by the other, i_5 goes out, and we get—I=

$$\frac{E}{\dfrac{(r_1r_4+r_3r_4)(r_1r_3+r_1r_5+r_3r_5+r_2r_3)+(r_1r_2+r_2r_3)(r_1r_3+r_1r_5+r_3r_5+r_1r_4)}{(r_1+r_2)(r_1r_3+r_1r_5+r_3r_5+r_1r_4)+(r_3+r_4)(r_1r_3+r_1r_5+r_3r_5+r_2r_3)}}$$

By dividing the top and bottom of the portion below the thick line by $r_1 + r_3$, we finally get—

$$I = \frac{E}{\dfrac{r_5 [(r_1 + r_3)(r_2 + r_4)] + r_1 r_2 (r_3 + r_4) + r_3 r_4 (r_1 + r_2}{r_5 [(r_1 + r_3) + (r_2 + r_4)] + (r_1 + r_2)(r_3 + r_4)}}$$

Substituting the value of the several resistance given in the problem, viz.,—

$$r_1 = 3000,$$
$$r_2 = 1000,$$
$$r_3 = 2000,$$
$$r_4 = 4000,$$
$$r_5 = 1000,$$

we get—

$$R = \frac{1000 [(3000 + 2000)(1000 + 4000)] + 3000 \times 1000}{1000 [(3000 + 2000) + (1000 + 4000)] +}$$
$$\frac{(2000 + 4000) + 2000 \times 4000 (3000 + 1000)}{(3000 + 1000)(2000 + 4000)} =$$
$$= \frac{75000}{34} = 2205\tfrac{15}{17}.$$

Telegraphic Communication with the Isle of Wight.—Communication was restored late on Saturday, the 7th inst., a new cable having been laid across the Solent. The *International* is now on her way to Guernsey for the purpose of inspecting the damage to the Channel Islands cable.

QUADRUPLEX TELEGRAPHY.

Duplex Telegraphy having now been established as a system, and its great value under certain conditions having come to be generally recognised, we are not surprised to find that in more than one quarter efforts are being made to utilise the discovery made in 1855, by Dr. Stark, of Vienna, of sending two messages simultaneously along a wire in the same direction, and to introduce, based upon that, a system of Quadruplex Telegraphy. From the American *Journal of the Telegraph* we learn that Mr. Prescott and Mr. Edison have been industriously at work for some time past in this direction, upon the lines of the Western Union Company, and, to judge from what follows, their efforts have been attended with success. The journal states that betwixt New York and Boston "402 messages, taken at random from the current business of the day, were sent over a single wire 300 miles long, and copied in a good legible hand in one hour and a half, Four operators were employed in sending, and four in receiving. The messages were of average length, and fairly represented the ordinary correspondence of the lines. The operators were all first-class, and worked as fast as they could, one of them receiving 90 messages in an hour. They could not, of course, keep up this speed all day, but they demonstrated the fact that they could do fully as much business on one wire with the Quadruplex as they could on four wires with the ordinary Morse apparatus. Since then this invention has been constantly and uninterruptedly working between these two cities, and regularly and fairly doing the work of four wires on one. The apparatus is now being made for extending its use upon longer circuits, and we hope soon to be able to announce the fact that it is working satisfactorily between New York and Chicago. The value of such an invention can at first scarcely be realised. It is really worth more to the Company than the wires which it replaces, or rather represents, for upon these imaginary wires there are no charges for interest, taxes, or maintenance—the latter item alone costing 8 dols. per annum for each mile of wire in operation. Between New York and Chicago alone the use of the Quadruplex upon one wire would give extra facilities which, if the Company had to erect additional wires to secure, would cost over 25,000 dols. per annum simply for repairs, to say nothing of the interest on the investment, the taxes on the additional property, and the annual deterioration of the plant." Mr. Orton, the President of the Western Union Company, in a report lately submitted by him, bears witness to the value of this new invention, and states that it has been "satisfactorily performing an amount of work upon one wire quite equal to the capacity of four wires worked with the ordinary Morse apparatus."

A meeting of electricians and practical telegraphers was held in Chicago, Illinois, on the evening of September 14th, for the purpose of taking preliminary measures towards the organisation of a national association for the advancement of electrical science. At this meeting it was decided to form such an association under the name of "The American Electrical Society," and a committee of five was appointed to draft a suitable Constitution and By-Laws for its government. We are promised further particulars respecting this Society.

EXPERIMENTS ON THE DISSIPATION OF ELECTRICITY BY FLAMES.

By J. W. FEWKES.

By means of an electrometer made on the principle of Sir William Thomson's quadrant, I have been able to perform a few experiments in relation to the dissipation of small quantities of electricity by different kinds of flames. The experiments were conducted with such small quantites of electricity as could be obtained by rubbing a vulcanite plate, 6 inches square, with a cat-skin. The sensitiveness of the electrometer to the electricity thus formed was very great. The experiments are given below:—

Exp. 1.—An alcohol lamp, carefully insulated, was connected with the electrometer. The sections of the quadrant to which it was attached were then charged by means of the vulcanite plate, the opposite sections being at the same time in connection with the earth. The lamp was then carefully lighted. The spot of light, which had been deflected to the edge of the scale by the charge, quickly returned to the zero point, indicating a quick dissipation of the electricity by the flame.

Exp. 2.—The same conditions as those in Exp. 1 were observed, with the exception that a Bunsen burner was substituted for the alcohol lamp. The dissipation of electricity was the same as before, and took place, as near as could be observed, at the same rate as before.

Exp. 3.—I then substituted for the Bunsen flame a very fine jet of light, obtained by passing the gas through a finely pointed glass tube. The results obtained from this experiment indicate that the rate of dissipation is in no respect related to the size of the flame.

Exp. 4.—The end of the wire connected with the quadrant was then placed so that when the gas was lighted the wire point would be in the flame. The quadrant was then charged, and the gas turned on without being lighted. The spot of light had no movement, and gave no sign of any loss of electricity by the quadrant. An artificial current of air across the wire point likewise had no effect in dissipating the charge.

Exp. 5—The end of the wire was then placed in the jet of an atomiser, the same conditions being observed as in Exp. 1. The fine globules of steam and water issuing from the atomiser had no effect in dissipating the electricity of the quadrant.

I also performed two very striking experiments, which seemed to have some bearing upon this subject. The instruments used were the same as in the former experiments, and the manipulation was as follows:—

Exp. 1.—Carefully insulate a wire communicating with the electrometer, and place its point within a few inches of the flame of an insulated Bunsen burner. Let the spot of light be at the zero point. Electrify the vulcanite plate with the cat-skin, and hold it at an equal distance from flame and wire point. It is very difficult, under these conditions, to sufficiently electrify the quadrant so as to produce any deflection of the spot of light.

Exp. 2.—Place the wire point in the flame, and then hold the electrified vulcanite plate up to the flame, as before. The spot of light immediately is violently deflected, indicating the presence of electricity in the quadrant. This change, however, is soon dissipated by the flame, and the spot quickly returns to the zero point.

These last experiments seem to indicate that the flame has a much greater attraction for the electricity of the vulcanite plate than the copper point of the wire. Hence the difficulty of charging the quadrant in the first experiment. When, however, the wire is in direct communication with the flame, as in the second experiment, the flame and the quadrant are at the same potential, and the increase of electricity in the flame produces a corresponding deflection of the spot of light.

THE "SNAPPER" SOUNDER.

The advantages of acoustic reading in telegraphy have now come to be so generally recognised that anything which tends to facilitate its acquirement will be readily welcomed. Hitherto the only means at the disposal of learners who were desirous of qualifying themselves in this branch of their work have been simply to practise at an ordinary Morse instrument. Now, however, by the invention of Mr. Wessmann, an American, the real difficulty in the way of acquiring a knowledge of reading by sound has been surmounted, and an instrument within the reach of every telegraph clerk does all that is required of it as well as the Morse would do. The essential principle of the "Snapper" Sounder—for so the miniature apparatus is named—is a steel spring, about an inch in length, indented at the middle by a smart blow or two from a hammer. This spring when depressed emits a clear sound, followed by another equally clear on its being allowed to resume its normal position. These sounds correspond to the down and up strokes of the armature of an ordinary sounder; and as sound reading depends entirely upon the *duration* of sound, the "dots" and "dashes" are formed according to the interval which is allowed to elapse betwixt these successive snaps,—in other words, according to the time that the steel spring is kept depressed.

These little instruments will be of the greatest service to the telegraph clerks throughout the country, more especially as we understand that the Postal Telegraph Department is rapidly extending the use of Sounders by converting all the inking circuits to Sounders, and rendering a good knowledge of reading by sound a *sine qua non* of promotion.

In America they have been largely taken up, not merely by those connected with telegraphy, but by the outside public as well, many of whom have qualified themselves to keep up a conversation with each other by means of them.

The Government and the Atlantic Telegraphs.—The *Pall Mall Gazette* of the 11th inst. contained the following correspondence:—

"Direct United States Cable Company,
48, Palmerston Buildings, Nov. 10, 1874.

"To the Rt. Hon. the Chancellor of the Exchequer.

"Sir,—A report has reached this Company that the Government is preparing to purchase Atlantic Telegraph lines. We would request the favour of being informed whether this is the case, in order that we may lay the subject before our Shareholders.

"I am, Sir, your obedient servant,
"Edward H. Lushington, Chairman."

"11, Downing, Street, Whitehall, Nov. 11, 1874.

"Sir,—I am directed by Sir Stafford Northcote to acknowledge the receipt of your letter of yesterday's date. In reply I am to inform you that the Government cannot be responsible for any reports which may have reached you; but that they have taken no steps, and have no intention of taking any, for the purchase of the Atlantic Telegraph or any other ocean line.

"I am, Sir, your obedient servant,
"W. S. Northcote.

"Edward H. Lushington, Esq."

COMPARATIVE STATISTICS OF GOVERNMENT ELEGR

Statistical Objects.	Germany.	Bavaria.	Wurtemburg.	Austria.	Hungary.	Belgium.	Denmark.	Spain.	France.
I.—SYSTEM.									
Length of Lines in Miles	17,661	4,256	1,378	11,995	7,781	2,853	1,529	7,287	29,481
„ Wires in Miles.. ..	60,816	13,875	3,000	31,510	26,334	10,947	3,988	16,572	79,690
II.—OFFICES.									
Number of Offices—									
Open for International and International Service	3,058	755	220	1,657	764	522	108	214	3,463
Open only for Internal Service		—	4	2	—	—	61	1	—
Total	3,058	755	224	1,659	764	522	169	215	3,463
Number of Offices—									
Government	1,391	392	224	712	346	405	105	213	2,071
Railroad or private companies	1,667	363		945	418	117	62	1	1,257
Semaphorical with tel. service	—	—		2	—	—	2	1	135
Total	3,058	755	224	1,659	764	522	169	215	3,463
Number of Offices—									
With Permanent Service ..	30	6	2	47	78	13	2	75	10
„ Full Day..	1,960	26	139	363	150	160	125	55	1,831
„ Limited	1,068	723	83	1,249	536	349	42	85	1,622
Total	3,058	755	224	1,659	764	522	169	215	3,463
Number of Depot Offices			2	13	—	278	—	—	—
III.—APPARATUS.									
Number of Apparatuses in Use:									
Morse System	3,157	704	368	1,245	1,069	874	207	408	2,420
Hughes's System	88	10	4	40	8	14	—	—	217
Other Systems	8	475	—	—	4	22	—	—	1,510
Total	3,253	1,189	372	1,285	1,081	910	207	408	4,147
IV.—PERSONNEL.									
Chief and Central Administration Officers	261	25	11	163	83	50	16	31	376
Number of Office *Employés* ..	4,519	218	87	1,351	1,039	694	251	956	3,303
Subaltern *Personnel*	789	79	30	1,236	283	836	141	839	1,581
Total	5,569	322	128	2,750	1,405	1,580	408	1,826	5,260
V.—MESSAGES.									
Interior Service—									
No. of messages (paid) sent..	6,511,375	539,444	228,585	2,818,697	2,013,471	1,585,196	237,902	839,446	395,76
„ „ (free) „ ..	272,158	61,110	—	3,714	2,530	4,148	—	182,315	608,70
Total	6,783,533	600,554	228,585	2,822,411	2,016,001	1,589,344	237,902	1,021,761	004,46
International Service—									
No. of messages sent abroad..	1,443,972	334,068	168,868	715,690	82,995	310,261	107,438	93,528	827,58
Ditto received from abroad ..	1,554,079	362,841	181,167	638,721	87,344	350,262	109,331	102,315	914,15
Ditto sent transit	354,739	278,768	47,394	501,189	170,522	157,496	129,881	37,049	306,20
Total	3,352,790	975,677	397,429	1,855,600	340,861	818,019	346,650	232,892	047,9
No. of Service messages ..	21,718	—	176,287	118,116	258,086	790,711	18,765	49,607	—
Total General of messages	10,158,041	1,576,231	802,301	4,796,127	2,614,948	3,198,074	603,317	1,304,260	052,4
VI.—RECEIPTS (in dols.)									
Proceeds of Interior corresp'nce	1,227,414	62,411	36,412	1,304,163	498,643	164,816	46,913	206,447	359,2
„ International ditto	1,020,973	143,639	37,824		56,270	172,098	79,445	148,436	021,7
Sundry receipts	23,852	1,829	2,019	125,572	25,508	437	3,029	—	150,6
Total	2,272,239	207,879	76,255	1,429,735	580,421	336,914	129,387	354,883	531,7
VII.—EXPENDITURE (in dols.)									
Extraordinary Budget—									
Expenses for the construction of new lines	206,530	27,548	37,573	384,906	116,996	61,877	16,631	—	223,8
Ordinary Budget—									
Personnel	1,566,459	87,305	48,805	844,044	452,919	210,224	85,853	591,900	[illegible]
Expenses of working and maintenance of lines and offices	659,813	49,434	26,469	553,550	320,919	144,670	30,502	105,976	639,0
Total	2,432,802	164,287	112,747	1,782,500	890,834	416,771	132,986	697,876	762,8
GENERAL OBSERVATIONS.									
Population according to census	34,373,253	4,852,026	1,818,484	20,394,498	15,417,327	5,113,680	1,784,741	16,732,052	102,9

ELEGRAPHS FOR 1872.—*From the Journal of the Telegraph.*

France.	Great Britain.	British Indo-European.	British Indian.	Italy.	Norway.	Portugal.	Holland.	Dutch E. Indies.	Russia.	Sweden.	Switzerland.
29,481	23,878	3,378	15,568	12,087	4,012	1,929	2,039	2,843	34,914	4,371	3,429
79,690	99,918	3,414	31,040	41,543	6,247	3,550	6.992	3,458	68,858	11,196	7,837
3,463	5,474	10	511	1,318	148	120	281	51	457	199	707
—	—	—	259	—	—	—	1	—	876	130	—
3,463	5,474	10	770	1,318	148	120	282	51	1,333	320	707
2,071	3,654	10	198	789	95	111	145	51	650	111	629
1,257	1,815	—	567	497	52	1	137	—	681	209	78
135	5	—	5	32	1	8	—	—	2	—	—
3,463	5,474	10	770	1,318	148	120	282	51	1,333	320	707
10	35	6	610	70	1	6	3	—	686	3	5
1,831	5,413	—	66	203	103	44	183	16	351	49	46
1,622	26	4	94	1,045	44	70	96	35	296	268	656
3,463	5,474	10	770	1,318	148	120	282	51	1,333	320	707
—	31	—	—	4	—	—	—	—	142	4	54
2,420	1,734	30	553	1,511	187	175	325	89	1,489	444	933
217	26	—	—	39	—	—	20	—	76	—	22
1,510	5,782	—	—	—	65	12	—	—	—	192	—
4,147	7,542	30	553	1,550	252	187	345	89	1,565	636	955
376	644	36	465	225	22	59	40	19	255	20	28
3,303	6,323	79	927	1,769	344	359	612	171	3,421	338	1,055
1,581	3,609	344	1,322	1,536	216	232	262	165	1,805	173	51
5,260	10,576	459	2,714	3,530	582	650	914	355	5,481	531	1,134
5,395,762	15,369,894	—	606,294	3,308,866	344,695	177,856	1,217,837	188,060	2,527,468	551,802	1,480,757
608,700	165,886	—	5,008	147,730	—	32,933	—	12,221	24,235	12,017	17,528
6,004,462	15,535,780	—	611,302	3,456,596	344,695	210,789	1,217,837	200,281	2,551,703	563,819	1,498,285
827,581	1,002,216	—	25,849	337,760	95,657	32,953	274,728	5,156	246,030	111,783	251,707
914,153	869,107	20,199	24,613	364,485	111,659	34,954	310,223	5,261	250,679	113,211	246,597
306,207	—		27,632	161,254	22,330	10,735	215,885	1,772	27,577	62,601	150,158
2,047,941	1,871,323	20,199	78,094	863,499	229,646	78,642	800,836	12,189	524,286	287,595	648,462
—	—	—	36,945	125,379	30,355	29,849	12,416	16,181	183,563	863,874	25,111
8,052,403	17,407,103	20,199	726,341	4,445,474	604,696	319,280	2,031,089	228,651	3,259,552	1,715,288	2,171,858
,359,298	3,905,825	207,180	593,682	826,758	114,053	46,014	151,493	112,717	2,776,671	150,586	158,940
,021,787	882,995		258,057	412,449	83,135	21,630	106,468	7,632	591,749	116,621	139,285
150,662	219,510	25,197	11,696	14,330	1,658	2,203	—	273	55,622	3,054	20,059
,531,747	5,088,330	232,377	863,435	1,253,537	198,846	69,847	257,961	120,622	3,424,042	270,261	318,284
223,800	5,655,875	77,700	731,056	121,285	36,499	3,715	37,266	12,620	828,606	56,550	19,000
900,000	4,568,445	267,165	1,245,879	704,350	111,202	137,811	375,186	160,744	1,482.590	143,321	167,313
										54,091	124,115
639,000		95,620	103,598	264,451	64,757	24 492		49,418	1,099,999		
.762,800	10,224,320	440,485	2,080,533	1,090,086	212,458	166,018	412,452	222,782	3,411,195	253 962	310,428
,102,921	31,028,338	—	236,523,542	26,801,154	1,763,000	3,829,618	3.637,279	20,052,890	78,394,471	4,250,402	2,670,345

EXPERIMENTAL DETERMINATION OF THE DIELECTRIC CONSTANTS OF INSULATORS.

By L. BOLTZMANN.

FARADAY found, in the eleventh series of his "Experimental Researches" (*Pogg. Ann.*, vol. xlvii., pp. 1 and 537), that the capacity of condensers depends not alone on the shape and the mutual distance of the metallic plates, but also on the nature of the interposed insulating layer. Siemens showed that this phenomenon cannot proceed from the gradual penetration of the electricity into the insulating body. This property of insulators to modify the capacity of condensers, or, in more general terms, to alter the distribution of electricity in adjacent conductors, was named by Faraday their *dielectricity*. The first detailed theory of this property was given by Maxwell (*Philos. Transactions*, vol. clv., part 1, p. 459), and subsequently still more completely by Helmholtz (*Borchardt's Journal*, Bd. lxxii., p. 57). The electric potential alters continuously on its entrance into the dielectric body. But its differential quotient, in the direction of the normals drawn to the body, changes abruptly, and in such a manner that if we represent the value of this differential quotient on the outer side of the insulator by—

$$\frac{\delta V}{\delta N a},$$

and that on the inner side by—

$$\frac{\delta V}{\delta N i}$$

(both normals being drawn in the same direction), the ratio—

$$\frac{\delta V}{\delta N a} : \frac{\delta V}{\delta N i}$$

is a constant depending merely on the nature of the insulator, which we may therefore call its dielectric constant. From this condition, and from the condition that V in the interior of all insulators likewise agrees with the equation—

$$\frac{\delta^2 V}{\delta x^2} + \frac{\delta^2 V}{\delta y^2} + \frac{\delta^2 V}{\delta z^2} = 0,$$

the distribution of electricity in any given system of conductors and insulators may be calculated if the former are charged from given sources of electricity. The author's object was to examine certain insulators, and ascertain if their behaviour corresponded with the theory of Maxwell and Helmholtz, and, if not, to determine their dielectric constants as accurately as possible. The numbers which he has found differ sensibly from those given by other observers, as is shown in the tables which are appended.

The dielectric constant is rendered of especial importance in connection with our view of the constitution of matter, for, according to the theory of Maxwell, if light and electricity are vibrations of one and the same medium, the quotient of refraction is the geometric mean between the constants of dielectricity and of magnetisation. The table at the end shows that the author's results, so far, confirm this theory.

The method adopted was as follows:—The capacity of a common Kohlrausch condenser, with two vertical metal plates, was first measured at different distances betwixt the plates. It was found, after deducting the capacity of the conducting wires, to be inversely as the distance of the plates. By capacity of a conductor in general, the author understands the quantity of electricity which it takes up when it is charged from a source of electricity. It naturally depends on the surrounding dielectric or conducting bodies. By the capacity of a condenser he understands the amount of electricity which one of its plates receives when connected with a source of electricity, whilst the other plate is connected with the ground. Discs of the insulating substances, of different thickness, were then introduced between the two plates of the condenser, and its capacity again determined, the thickness of the insulating disc—as well as the distance betwixt the plates of the condenser—being measured each time. According to the theory of Maxwell and Helmholtz, the capacity of the condenser—neglecting the electricity on the margin of the plates—depends merely on the distance m of the condenser plates and the thickness n of the dielectric stratum; and if D represents the dielectric constant of the intermediate stratum, it is inversely proportional to the expression—

$$m - n + \frac{n}{D},$$

therefore inversely proportional to the distance betwixt the condenser plates. By means of this theorem—which was verified by manifold experiments with insulating plates of different thicknesses and different distances betwixt the plates—the influence of the stratum of air which exists between the plates, in addition to the dielectric body, can be calculated, and the dielectric constant can be found. The following values were thus determined:—

For vulcanite	3·15
„ paraffin	2·32
„ sulphur	3·84
„ resin	2·55

For determining the quantities of electricity the author made use of Thomson's electrometer, and for charging the condenser he employed a Daniell's battery of 18 elements. In order to measure the capacity of the condenser, the electrometer was first charged directly by the battery, and the indication noted. One condenser plate was then charged at the battery, whilst the other was connected with the earth. The charged plate was then separated from the battery and connected with the electrometer. A part only of its electricity was transferred to the electrometer, and the indication of the latter was therefore smaller than before; and from the two indications the relation of the capacity of the condenser to that of the electrometer was found. The capacity of the condenser was thus measured, taking that of the electrometer as unity. To ascertain if the penetration of electricity into the insulator had any disturbing influence, the experiment was on one occasion so modified that the condenser plate was charged at the battery for a couple of seconds, and was then connected with the battery for about a minute. Then, again, it was so arranged that the experiment lasted only the fraction of a second. With the substances above mentioned no difference was detected in the two cases. In order to test, also, the case where—along with the dielectric body—no air exists between the condenser-plates, the author laid the insulating disc upon a mercurial mirror, and poured mercury over it, which was prevented from flowing away by a margin of paper. The results thus obtained agreed with the former. Finally, some experiments were made with imperfect insulators,—glass, stearine, and gutta-percha,—whose behaviour with electricity could thus best be proved.

The author then proceeds to give a detailed account of his experiments, in which he employed a Thomson's quadrant electrometer, made by White, of Glasgow.

We extract the values found for the dielectric constants of the substances examined:—

For Vulcanite.

(*a*). With the Condenser of Kohlrausch.

Plate I.			Plate II.		Plate III.	
3·14	3·19	3·20	3·09	3·19	3·19	3·21
3·17	3·17	3·16	3·12	3·13	3·34	3·35
3·12	3·14	3·15	3·16	3·13		
Mean 3·17.			Mean 3·11.		Mean 3·20.	

(*b*). With the Mercurial Condenser.

Plate I.	Plate II.	Plate III.
3·04	3·03	3·26
3·09	3·13	3·21
	3·14	3·24

The most probable value is 3·15.

For Paraffin.

(*a*). With the Condenser of Kohlrausch.

Plate I.			Plate II.		Plate III.
2·28	2·29	2·28	2·34	2·33	2·31
2·25	2·25	2·27	2·35	2·36	
Mean 2·28.			Mean 2·34.		

(*b*). With the Mercurial Condenser.

Plate I.		Plate II.
2·30	2·31	2·33

As plates II. and III. contained purer paraffin, the probable value for pure paraffin is 2·32. Gibson and Barclay found 1·976. Siemens gives for stearine D=0·79,—possibly a typographical error. Faraday found for spermaceti numbers between 1·6 and 2·2.

For Sulphur.

Plate I.		Plate II.	
3·87	3·83	3·84	3·82

Probable value 3·84. Siemens found 2·9. Faraday gives figures between 2·16 and 2·32.

For Resin (Colophonium).

Plate I.		Plate II.		
2·58	2·56	2·52	2·54	2·54

Most probable value 2·55. Faraday found for shellac 1·9 to 2·1, and for glass 1·44 to 1·92.

The variations from the results of former observers are too great to be explained by a difference in the materials; nor can they be explained by a difference of the temperature at which the observations were made, since Gibson proved that the dielectric constant does not vary appreciably with the temperature. The author found, also, no variation in the constants produced by changes of temperature. He supposes that his predecessors used less delicate instruments for measuring the quantity of electricity, and that they assumed the space between the condenser-plates to be entirely filled with the insulating body, which is never the case. In addition, the condenser-plates are easily pushed further apart in the attempt to fill up too completely the space between them. Both these circumstances, together with the neglect of the influence of the border, would make the calculated value of the dielectric constants too small.

To facilitate a comparison between his results and the theory of Maxwell, according to which the index of refraction, *i*, of any substance is the square root of its dielectric constant, the author gives the subjoined table of indices of refraction, with the square roots of those values of D which he considers the most probable:—

	$\sqrt{D}$	i	
Sulphur	1·960	2·040	
Resin...	1·597	1·543	
Paraffin	1·523	1·536	1·516

POLARISATION OF THE PLATES OF CONDENSERS.

By A. S. THAYER.

It is well known that in polarisation batteries of which Planté's battery is a type, a combination of the ions—resulting from electrolysis—takes place when the plates of the battery are connected, and a current results which slowly diminishes in strength. In the case of condensers made with solid dielectrics the same diminishing current is observed, and the following experiments would seem to show that it might be due to an electrolysis or decomposition of the material separating the plates of tin-foil. The experiments consisted in placing condensers of various kinds in a circuit, through which a current was made to pass by two Bunsen's cells, and noting their changes. The plates of the condensers were of tin-foil, and had an area of about 15 square inches. The experiments were as follows:—

(1) The dielectric used was a sheet of dry glazed paper. The condenser could not be charged so as to give a perceptible discharge.

(2) When a sheet of glazed paper, moistened with shellac, was substituted for the dry paper, the discharge was sufficient to send the light off the scale of the galvanometer, and continued for some minutes.

(3) Dry goldbeater's skin was used as a dielectric, and no deflection could be obtained.

(4) The goldbeater's skin, when moistened with shellac, gave a slowly diminishing deflection.

(5) The dielectric was made by flowing the surfaces of the plates with a solution of wax and gasoline, and a slowly diminishing deflection was obtained.

(6) The condenser used in (4) was tried again after the shellac had dried, and again gave a diminished deflection, less than the first deflection.

(7) The condenser used in (5), when tried again after a day or two, did not again give a deflection.

(8) Unglazed paper, dry and oiled, gave no deflection.

(9) Glazed paper, oiled, gave a very slight deflection, and the galvanometer needle immediately returned to zero.

(10) Glazed paper, wet with water and covered with shellac, gave the greatest deflection of all the dielectrics. The light was sent completely off the scale, and was only brought back by shunting the galvanometer. The discharge also continued a long time.

(11) The conducting power of some of the various dielectrics was tested. The goldbeater's skin which had been covered with shellac transmitted no current after it had been allowed to stand for a week. Freshly oiled and dry oiled paper did not conduct at all. Glazed paper, covered with shellac, gave a deflection nearly off the scale. Glazed paper, wet with water and covered with shellac, transmitted a current sufficient to send the light entirely off the scale.

What these experiments directly go to show are—first, that condensers with moist dielectrics received a greater charge than those made with dry, and, second, that the better the dielectric conducted, the greater the charge the condenser was capable of receiving. From these facts it would seem that the slow discharge of these condensers was very probably due to polarisation. The best condensers, as shown by the experiments, possessed considerable conductivity. The dielectrics when dry scarcely conduct at all. Their conduction when moist must therefore have been mainly due to electrolysis, since liquids conduct electricity only in very small quantities without being decomposed. The electrolyte was therefore decomposed, and the recombination of the products of decomposition caused the return current. An exact analogy is thus determined between the case of the lead plates and these condensers. Whether it is an analogy that would hold good in the case of all condensers which slowly discharge themselves is an interesting question.

INCREASE OF MAGNETISM IN A BAR OF SOFT IRON UPON THE REVERSAL OF THE MAGNETISING CURRENT.

By WILLIAM A. BURNHAM.

In testing the intensity of the magnetism induced in a bar of soft iron which forms the armature common to two electro-magnets, according to the method described by Mr. Sears,* the galvanometer indicates an increase in intensity of the magnetic state of the bar on the first passage of the current through the magnetising helices, after a reversal of the poles of the battery. This increasing disappears upon subsequent magnetisations of the bar. Various observations were taken by placing the induction coil, termed C, at different distances on the bar which was magnetised. A bar of soft iron was experimented with in the first instance, the coil being at a distance of 5 centimetres from the middle or zero point. A Thomson's reflecting galvanometer was used, and the readings were taken when the circuit was made, and also when it was broken.

Table I. shows the results with C at various distances from the bar. It will be seen by this table that when the coil C stands at a distance of 5 centimetres from the zero point on the armature, upon making the circuit, the galvanometer needle swings to the left 40°, and upon breaking the circuit it is deflected 40° to the right. The signs in the table denote this change of direction. When the poles are reversed and the circuit made it swings 90° to the right, and when broken 50° to the left, returning to the constant deflection of 40° upon the second and each succeeding passage of the magnetising current, while the poles remain the same. In the same manner, when the coil stands at 6, 7, 8, &c., the first swings of the galvanometer needle are respectively 50 to 50, 60 to 60, &c., increasing in regular proportion upon each reversal of the poles, and returning upon each second and succeeding passages of the current to constant deflections.

Table II. shows the results when a bar of steel was substituted for the soft iron. In the case of steel, when the coil C stands at a distance of 5 centimetres from zero, the galvanometer needle swings from +20° to −20°. Upon reversing the poles it is deflected +40° and 25°, and returns to 20° upon the second passage of the magnetising current.

By comparing Tables I. and II. it will be seen that the increase of magnetisation after a reversal of the poles is not so great in iron as in steel, owing, doubtless, to permanent magnetism in the steel.

A "Model Electric Telegraph," manufactured by Messrs. Theobald and Co., of Church Street, Kensington, has lately been brought under our notice. It is a working model of the single needle instrument, of the most ingenious—and at the same time simple—construction. The indicator is a small magnetic needle, suspended vertically upon a card-board dial, bearing the letters of the ordinary single needle alphabet: the coils are dispensed with, and in their place is substituted a small electro-magnet, which, according to the direction of the current passing through it, moves the needle to right or left, as the case may be. The sending portion of the apparatus consists of a very simple commutator arrangement, the same as that adopted in Bright's keys. The elements of a small Daniell's cell are supplied along with it. The instrument is excellently adapted for explaining the principles of the single needle telegraph, and might be advantageously employed for the training of learners, for whom it will fully answer all the requirements of the ordinary single-needle apparatus.

Table I.

Distances of C from the middle of the bar, in centimetres	5		6		7		8		9		10	
Constant deflections in making and breaking circuit	+ 40	— 40	+ 50	− 50	+ 60	− 60	+ 70	− 70	+ 80	− 80	+ 90	— 90
Deflection on the first passage of the current after changing the poles	− 90	+ 50	− 110	+ 60	− 130	+ 70	− 150	+ 80	− 170	+ 90	− 190	+ 100
Return to constant deflections on second and succeeding passages of current ..	− 40	+ 40	− 50	+ 50	− 60	+ 60	− 70	+ 70	− 80	+ 80	− 90	+ 90

Table II.

Distances of C from the middle of the bar, in centimetres	5		6		7		8		9		10	
Constant deflections on making and breaking circuit	+ 20	− 20	+ 30	− 30	+ 40	− 40	+ 50	− 50	+ 60	− 60	+ 70	− 70
Deflections on the first passage of the current after changing the poles	— 40	+ 25	− 50	+ 35	− 60	+ 45	− 70	+ 55	− 80	+ 65	− 90	+ 75
Return to constant deflections on second and succeeding passages of the current ..	− 20	+ 20	− 30	+ 30	− 40	+ 40	− 50	+ 50	− 60	+ 60	− 70	+ 70

* "American Journal of Science," July, 1874.

Proceedings of Societies.

SOCIETY OF TELEGRAPH ENGINEERS.

A MEETING (the first after the summer recess) was held at 25, Great George Street, Westminster, on Wednesday, the 11th inst.

Mr. LATIMER CLARK, Vice-President, in the Chair.

The CHAIRMAN said that, in the course of some civilities which had passed between this Society and the Society of Engineers, a letter had been received from the Secretary of that Society, Mr. Perry F. Nursey, stating that the members of his Society would always be glad to see members of this Society present at the ordinary meetings held at the Society's hall, No. 6, Westminster Chambers. There was no card of general invitation issued by that Society, but members of the Society of Telegraph Engineers would be admitted upon application.

The CHAIRMAN further said:—I have also to announce that some progress has been made in the acquirement of the library of Sir Francis Ronalds. I think you have been already informed that Sir Francis, who is now dead, has bequeathed a very large and valuable collection of electrical works to his son-in-law, with full powers to dispose of them as he thinks fit. That gentleman has already shown to us a draft agreement, by which the books will be transferred to the Society of Telegraph Engineers, subject to certain conditions. Those conditions are that we should print a catalogue of the library and publish it. Now, that is rather a large undertaking, but, I am happy to say, one not at all beyond our means. It is, however, a very much larger thing than you might at first sight imagine. It will cost £200 or £300 to print the catalogue alone, and the books themselves are of enormous value. These books will be transferred to the Society in trust, subject to a condition that on the death of certain specified persons, who will probably be members of the House of Peers, the library will be absolutely transferred to the Society of Telegraph Engineers if then existing. If the Society should dissolve in the meantime, those trustees would have power to transfer it to some other society, or to deal with it in some other way. I have great pleasure in making this announcement, for it is one of the most magnificent collections of electrical works that the world possesses. (Applause.)

A paper, "On Faults in Submarine Telegraph Cables," by Mr. J. J. Fahie, of the Persian Gulf, was then read by the Secretary.

Messrs. Adams, Phillips, France, and W. H. Preece, Professor Adams, and the Chairman, then entered into a discussion of the paper.

A cordial vote of thanks was accorded to the author.

The meeting was adjourned to the 25th inst.

An abstract of the paper, and a full report of the discussion, will appear in an early number of this journal.

Electrical Science in English and Foreign Journals.

(In addition to our usual abstracts, there will be found under this heading the titles of papers on electrical science which have appeared in English and foreign journals from the commencement of the present century up to the date of the establishment of this journal).

Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, Vol. lxxix., No. 14. October 5, 1874.

Note on Magnetism (continuation).—By J. M. Gaugain.—Referring to his previous papers, wherein are treated the modifications produced in the magnetic conditions of a horse-shoe magnet, when its branches are rubbed by a bar of iron, or when an armature applied to these branches (in different positions) is violently pulled off, the author proceeds to point out the theoretic conclusions which appear to result from the facts already demonstrated. He says—"When an armature is applied perpendicularly to the branches of a horse-shoe magnet, upon a line *m m* situated at a definite distance from the poles, its magnetism is increased in *amont*,* and is diminished in *aval*.* (I call *amont* that part of the magnet included between the heel and the line *m m*; *aval* the part comprised between that line and the poles.) It is natural to suppose that the permanent modifications which remain in force after the removal of the armature are governed by the same law; such is now, however, always the case. The magnetism is always lessened in a permanent manner in *aval* of the line upon which the pluckings off of the armature are accomplished; but it is at one time increased, at another diminished, in *amont* of that line. Suppose the disruptions of the armature, effected in *aval*, are the first that have been executed since the iron has been magnetised, then the magnetisations are lessened. But if this magnetisation has been previously weakened by a series of disruptions executed in *amont*, a portion of the lost magnetisation may be restored by carrying on a new series of disruptions in *aval*." This latter fact, the author thinks, may be explained thus:—Before the application of the armature the molecules of *m m*, like all the others, have their currents set perpendicularly to the axis of the horse-shoe, or at least come near to that aspect. When the armature is applied on the line *m m* it forms, with the portion of the horse-shoe situated in *amont*, a solenoid coiled at right angles to the axis of the horse-shoe. The molecules of the magnet then set variously. Those in the neighbourhood of the armature undoubtedly tend to assume their primitive inclinations when the armature is taken away; but by reason of coercive force they do not entirely do so,—to the loss of a portion of their magnetisation,—and then they cannot any longer efficiently maintain the neighbouring molecules of the magnet in the plane of inclination perpendicular to the magnet's axis. If this be admitted, there remains no uncertainty as to the nature of the modification which the magnetism of the molecules situated in *aval* of the line *m m* should experience; it ought to be weakened, because of the coercive force of these molecules, and because of the weakened action before mentioned. Lastly, the author endeavours to explain the phenomenon described in par. 77 on the supposition that a section of magnet may contain molecules endowed with different coercive forces, so that the application of the armature for a certain number of times enables all the molecules in that section to assume the inclination the armature tends to induce. The temporary diminution of magnetism produced in *aval* of the line *m m* results exclusively from the changes of inclination which the other molecules suffer (as referred to before)—changes which do not continue after the armature has been taken away. When, on the contrary, the armature is carried into *amont* of *m m*, upon another line, *m' m'*, molecules are found possessed of coercive force great enough to preserve the inclination given to them by the armature: hence the magnetism is there permanently diminished.

Spectro-Electric Tube, or Fulgurator, designed to observe the Spectra of Metallic Solutions.—B. Delachanal and A. Mermet.—It is composed of a capillary tube traversed by a platinum wire moving in it, and permitting a liquid to run from it drop by drop. This tube, surmounted by a reservoir which contains the solution to be examined, passes through a cork fitted into a closed tube, through the bottom of which another platinum wire passes, almost meeting the first. The whole is placed on an insulated support, and each of the electrodes is in communication with one of the platinum wires, and also with a Ruhmkorff coil. The inconveniences attending the use of the ordinary apparatus are that, if the spark is short, the meniscus of the liquid partly conceals it; if it is too long, it branches out in different directions, so as to hinder the continuous observation of the spectrum; if the apparatus is not shut up, the slit of the spectroscope is dirtied and corroded by the liquid being projected on all sides. These inconveniences are eliminated by the present invention: the spark opens out into the form of a tuft admitting of prolonged observation; the slit of the spectroscope is sheltered from accidents. An extra advantage is likewise gained in that the liquid under examination is preserved.

---

* The literal rendering into English of *amont* is *up the stream*, whilst *aval* signifies *down the stream*. It is used idiomatically with reference to the parts of a river above or below a bridge; and in that sense these words indicate the portions of the magnet above or below the line *m m*.—*Translator*.

An Electro-Diapason of Variable Period.—E. Mercadier.—In my two notes inserted in the *Comptes Rendus* of May 12th and 19th, 1873 (see TEL. JOURN., vol. i., pp. 178 and 192), I pointed out a very simple new method of electrically preserving the movement of a diapason. The arrangement then adopted is rendered more convenient by placing the electro-magnet between the branches of the diapason, and the plate and style interrupters on one of the sides. The advantage is then obtained, that a single electro-magnet, a single interrupter, a single battery, and a single stand, may serve for very different diapasons, provided that the interior distance of their branches be nearly the same.

No. 15. October 12, 1874.

On the Use of the Variable Period Electro-Diapason as Tonometres and Electric Interrupters.—E. Mercadier.—In continuation of his previous paper, M. Mercadier says his diapason can be used to register variable fractions of time from $\frac{1}{10}$th to $\frac{1}{1000}$th of a second at least. He explains how it may therefore be used to measure the vibrations of various tones; also how it may be employed as an electric interrupter to produce in a given apparatus—electro-magnet, galvanometer, induction-coil, eudiometer, &c.—intermitting currents or sparks of varying speeds.

No. 16. October 19, 1874.

On Magnetic Condensation in Soft Iron.—A. Lallemand.—Magnetic condensation, first discovered by M. Jamin in steel, takes place also in soft iron with a very remarkable strength and persistence. Let a horseshoe electro-magnet be formed of an iron cylinder, 4 c.m. in diameter, and round each branch let a wire spiral, 2 m.m. in diameter and 150 m. long, be wound; the armature to be a plate of soft iron, 2 c.m. thick and 4 c.m. wide. When the double helix is traversed by a current from a single Bunsen element, feebly charged, about 150 kilos. may be supported: on breaking the circuit 50 kilos. may still be supported; but, after the armature is detached, all trace of magnetism disappears, and the electro-magnet will not even attract its armature. Cohesion in no way causes the adhesion of the armature after suppression of the current, for no cohesion is manifested under a pressure greater than that afforded by the magnetism. Besides, a magnetised needle placed in the vicinity of one of the polar faces experiences a strong deflection, which disappears immediately after contact has been broken. In order to measure the quantity of magnetism condensed in the neighbourhood of the poles (under the influence of the armature), and to compare it with the small proportion of remanent magnetism preserved by the electro-magnet, I put the wire in connection with a Weber's galvanometer. The battery current having first circulated in the electro-magnet and determined the adhesion of contact, and the communication with the galvanometer being secured by means of a derivation, I detached the armature by sliding it away; the induced current developed gave the number 182. After some minutes the armature was replaced, and again detached in the same manner; the induced current numbered 5·5, and was a measure of the remanent magnetism. Thus the condensed magnetism was about thirty-three times as great as the remanent magnetism. But this relation is variable, depending on the strength of the current, dimensions, and form of the contact-piece, and nature of the iron of which the magnet is formed. The persistence of the condensed magnetism is most remarkable, for after twenty days the magnet continued to support 50 kilos., and on then detaching the armature the same value, 182, was given.

Les Mondes. Vol. xxxv., No. 7. October 15, 1874.

Has no original papers on Electricity.

No. 8.

On the Construction and Preservation of Lightning-Conductors.—R. Francisque-Michel.—A separate and full translation will appear in a future number.

Revista de Telégrafos. No. 19, Anno xiv. October 1, 1874.

This number contains an account of the present state of telegraphy in Mexico. The principal lines are—that from the city of Mexico to Matamoros, where it joins the system of the United States; its length is 1400 kilos.: the line from Quretaro to Leon, with branches to Salvatierra, Valle de Santiago, and Dolores Hidalgo, is 398 kilos. in length; that from Mexico to Salvatierra, by way of Toluca, extends to 222 kilos.; another line passes by Tacubaya to Acapulco, 376 kilos.: the line from Mazatlan, through Durango to Chalchihuites, measures 498 kilos.; that from Tehuacan to Oaxaca is 251 kilos. The grand total of the lines belonging to the Federal Goverment, to the States, and to private Companies, amounts to 8001 kilos. On the national lines seventy-three stations are open for service.

Sketch of the Progress of Maritime Telegraphy.—A paper read by Capt. Colomb before the Society of Telegraphic Engineers, London.

London by Night.—A paper taken from the *Eco de Ambos Mundos*, which seems decidedly out of place.

In the *Varieties* we read that an electro-magnetic machine has been recently tried in Paris, which seems a notable advance over the rest of its kind. It produces a continuous induced current, the rotation of the coils being at the rate of 350 revolutions per minute, the motive force required being from 2½ to 3 horse-power. Under these conditions the machine gives a current equal to that of 525 Bunsen elements. The light obtained is equal to that of 1000 gas-burners, or 9000 to 10,000 sperm candles. The spectrum of this light displayed a number of lines never seen before.

No. 20. October 15, 1874.

This number, in addition to the official section, contains an account of telegraphy in Central America; a visit to the central telegraphic station in Florence; the statistics of the telegraphic establishment of the Island of Puerto Rico; an account of the downfall of the "Pena de Azagva;" and a number of paragraphs of a nature not calculated to interest our readers.

Bulletino Telegrafico. Anno x., August, 1874.

In addition to its official portion, this number contains merely an article on Telegraphy in Australia, taken from the TELEGRAPHIC JOURNAL.

Allgemeine Deutsche Polytechnische Zeitung.
September 19, 1874. Jahrgang ii., No. 38.

This journal criticises a paper by Mr. Preece, which appeared in our columns (TELEGRAPHIC JOURNAL, vol. i., p. 214), and claims for M. Maron, Technical Member of the General Direction of the Imperial German Telegraph Department, the honour of the invention of the system of duplex telegraphy, based upon the principle of Wheatstone's bridge, which Mr. Preece, in the article in question, ascribes to Mr. Stearns.

City and Commercial Notes.

THE traffic receipts of the Great Northern Telegraph Company for the month of October were—This year, 438,817 francs; last year, 360,437 francs. Total traffic receipts, 1st January to 31st October—This year, 3,770,400 francs; last year, 2,748,568 francs.

The number of messages (of twenty words) passing over the Barcelona-Marseilles Cable, for the month ending 31st October, 1874, were 6731, against 5940 in September.

The traffic receipts of the Direct Spanish Telegraph Company, Limited, for October, 1874, were £1386 11s. 8d.

The traffic receipts upon the lines of the Western and Brazilian Telegraph Company, Limited, for the four weeks ending the 23rd September, were £9164, showing an increase upon those of the preceding four weeks of £2207.

The number of messages passing over the Cuba Submarine Telegraph Company's line during the month of September was 1773, estimated to produce £2000, against 1283 messages, producing £1300, in September last year.

The Eastern Telegraph Company's traffic receipts for the month of October, 1874, amounted to £32,853, against £29,229 in the corresponding period of 1873.

The traffic receipts of the Eastern Extension, Australasia, and China Telegraph Company, Limited, for the month of October, were £16,584, against £17,586 for the corresponding period of 1873.

The receipts of the Submarine Telegraph Company for the month of October last amounted to £9569 1s. Those for the corresponding month of the preceding year were £9564 16s. 10d.

The Anglo-American Telegraph Company have established themselves in new offices in Throgmorton Street. The main feature of the new arrangement is, that the Central Office is now connected by special wires with Valentia, and telegrams handed in at Throgmorton Street will be instantly carried to the Valentia Station, to be at once despatched thence through the cables to America. Messages for New York, the West Indies, and other places on the other side of the Atlantic, will therefore now be free from any delay which might naturally arise from their having to take their turn with the ordinary business of the English inland postal telegraphic service. Of course these benefits will also accrue to the City traffic from, as well as to, America. A further important advantage is obtained from the fact that American depatches received in the City are at once delivered at their destination by the special messengers employed by the Anglo-American Telegraph Company.

The Anglo-American Telegraph Company, Limited, have received a communication from the Colonial Office with reference to the Canadian Telegraphs Act passed in May last, but reserved by the Governor-General of Canada for Her Majesty's pleasure, to the effect that—legislation upon the subject being considered strictly within the competency of the Dominion Parliament—Lord Carnarvon is of opinion that the matter should be left in abeyance, with a view to a further examination of the whole subject in Canada, which has been recommended. It may be remarked that Section 27 of the British North American Act, 1867, enacts that "a Bill reserved for the signification of the Queen's pleasure" cannot have "any force" until the Governor-General signifies, either by Message to Parliament or by Proclamation, that it has received the assent of the Queen.

TELEGRAPH SHARE LIST.

Amount per Share.	NAME OF COMPANY.	Amount paid up.	Closing Quotations.
£		£	Nov. 12.
Stock	Anglo-American (Limited)	100	75—76
10	Brazilian Submarine..	All	7—7½
10	Cuba	All	6—6½
10	Direct Spanish	9	..—..
20	Direct United States Cable	All	12—13
10	Eastern (Limited)	All	7⅞—8⅛
..	Do., New	..	103—105
10	Eastern Extn. Australia and China	All	7⅞—8⅛
10	Globe Telegraph and Trust	All	6¾—7
10	Do., 6 per cent Pref...	All	9⅞—10⅛
10	Great Northern	All	10¾—11¼
25	Indo-European	All	18—19
10	Mediterranean Extension (Limited)	All	3¾—4¼
10	Do., 8 per cent Pref...	All	10½—11
10	Panama and South Pacific	2½	..—..dis
8	Reuter's..	All	11—11½
Stock	Submarine	100	205—210
1	Do., Scrip	All	2—2¼
10	West India and Panama	All	3⅞—4⅛
10	Do., 10 per cent Pref.	All	9¼—9¾
20	Western and Brazilian (Limited) ..	All	11—11½
1000 dls.	West Un. U.S. 7 per cent 1st M.B.	All	104—106
10	Hooper's Telegraph Works	All	12¾—13¼
50	India-Rubber and Gutta Percha ..	All	21—23
Cert.	Submarine Cables Trust	100	106—109
12	Telegraph Construction	All	28—29
100	Ditto Ditto 7 per cent Bonds	All	103—105

POSTAL TELEGRAPH CABLES.—It would appear that the recent stormy weather not only affected the land lines of the postal system, but the submarine lines as well, there being no fewer than three cables broken at the present moment, viz., the Channel Islands, the Isle of Wight, and the Isle of Arran cables. The broken Channel Islands cable is that between Dartmouth and Guernsey, a length of 66 miles. The cable is composed of only a single conducting wire, and the probability seems to be that the breakage is nearest to the Channel Islands end. The Isle of Wight cable is submerged between Hurst Castle and Sconce Point, near Yarmouth, and contains seven wires, five of which have hitherto been in constant use. It appears to have suffered damage from that constant source of danger to telegraph cables—a ship's anchor; and, as it is little more than a mile in length, it is not improbable that it may have to be altogether renewed, there being great difficulty—owing to the rapidity of the currents in the Solent—in picking up and repairing a cable in that situation. The Isle of Arran is served by a cable of a single wire submerged between Imachar Point and Carradale, on the coast of Cantyre, a distance of between 3 and 4 miles; and here also the damage was caused by a ship's anchor. The whole of these cables will, it is hoped, be very speedily repaired, the screw-steamer *International* having dropped down the river yesterday, on her way to Lowestoft, to take on board the necessary lengths of cable and stores at the submarine depôt of the Postal Department there. As regards the despatch of telegrams for the Channel Islands, it may be useful to state that such may be forwarded by wire to Southampton or Weymouth, and thence by steamer to their destination. There is still, of course, a complete telegraphic service to the Channel Islands by way of France, the rates being from London to Jersey, 7s. 6d., and to Alderney and Guernsey 8s. 6d. A shilling extra on each of these rates is chargeable on messages sent from the Provinces to the Channel Islands by this route.—*Times, Nov.* 3.

Patents.

Applications for Letters Patent.

3351. W. R. Lake, of the firm of Haseltine, Lake, and Co., patent agents, Southampton Buildings, London, "Improvements in galvano-hydrostatic apparatus for igniting, illuminating, and telegraphic purposes."—A communication to him from abroad by W. Lanbrecht and F. Wippern, Doctor of Laws, both of Vienna, Austria. *Dated September* 30, 1874.

3359. A. Mouillard, of Boulevard de Strasbourg, 28, at Paris, "An improved apparatus for composing and transmitting the signs or letters of Morse's telegraphic apparatus." *Dated October* 1, 1874.

3432. T. S. Johnston, of Edinburgh, lithographer, "A new and improved process of producing stereotype and electrotype plates or blocks from lithographic stones, for letter-press printing and similar purposes." *Dated October* 7, 1874.

3509. E. H. C. Monckton, of Fineshade, Northamptonshire, "Improvements in galvanic batteries and in the means of generating the electric current, and in their application to produce motive power and other useful objects, and for the apparatus and appliances necessary to effect the same."—(Complete Specification). *Dated October* 12, 1874.

3511. G. H. Jones, surgeon dentist, 57, Great Russell Street, Bloomsbury, and R. G. White, 3, Edith Grove, West Brompton, "An improved method of an apparatus for lighting and extinguishing gas lamps by galvanic and electro-magnetic influence." *Dated October* 13, 1874.

3521. W. H. Preece, of Southampton, Civil Engineer, C. Goldstone, of Southampton, telegraph engineer, J. Radcliffe, of Retford, Nottingham, telegraph engineer, and M. Gray, of Blackheath, engineer, "Improved means for communicating between passengers and the guard and engine-driver of railway trains." *Dated October* 13, 1874.

3771. A. M. Clark, of 53, Chancery Lane, patent agent, "An improved electrical commutator, together with the applications of the same."—A communication to him from abroad by H. Lartigue, of Paris, France. *Dated October* 31, 1874.

3793. W. Bevan, of Newtown, Cardiff, electrician, "Improved electric point indicator apparatus for railways." *Dated November* 3, 1874.

3800. H. Timmins, of St. John's Works, Southall, Middlesex, engineer, "Improvements in apparatus and arrangements for connecting and joining the wires used for electric telegraphs, and also the wires and wire ropes used for fencing." *Dated November* 4, 1874.

Grants of Provisional Protection for Six Months.

2999. P. Jensen, of 89, Chancery Lane, "Improvements in transmitting and printing telegraphic messages, and in apparatus therefor."—A communication to him from abroad by Paul la Cour, of Copenhagen, in the kingdom of Denmark.

3033. J. B. Thompson of Whitehall, Wraysbury, in the county of Bucks, "Improvements connected with the process of coating steel, iron, and cast-iron, with gold, silver, and other metals or alloys."

3037. W. R. Lake, of the firm of Haseltine, Lake, and Co., patent agents, Southampton Buildings, London, "Improved printing telegraph apparatus."—A communication to him from abroad by G. W. Howe, of Stevenson, Alabama.

3041. J. Oppenheimer, of Manchester, merchant, "Improvements applicable to electric telegraph instruments."

3089. H. B. Greenwood, of Minson Road, South Hackney, in the county of Middlesex, "Improved electro-magnetic apparatus for operating clocks or time-keepers."

3006. H. Highton, M.A., of Putney, in the county of Surrey, "Improvements in submarine telegraphy."

3056. J. H. Johnson, of 47, Lincoln's Inn Fields, in the county of Middlesex, gentleman, "Improvements in printing telegraphs, and in the codes of signals employed therewith."—A communication to him from abroad by Louis Victor Mimault, of Paris, France.

3148. W. Morgan-Brown, of the firm of Brandon and Morgan-Brown, engineers and patent agents, of 38, Southampton Buildings, London, and 13, Rue Gaillon, Paris, "Improvements in preparing the surfaces of china, glass, or earthenware, to receive metallic deposits by electro-chemical action."—A communication to him from abroad by Eilev Hansen, of Raadhusstrœde, Copenhagen.

3185. R. Burn, jun., and L. J. Green, both of Epsom, in the county of Surrey, "Improvements in apparatus for working and interlocking the points and signals of railways.'.

3222. G. E. Smith, of George Street, Nottingham, "Improvements in galvanic batteries."

3250. A. M. Clark, of 53, Chancery Lane, in the county of Middlesex, patent agent, "Improvements in electric printing telegraphs."—A communication to him from abroad by Ludovic Charles Adrien Joseph Guyot d'Arlincourt, of Paris, France.

3311. E. G. Wright, of 23, Southampton Street, Bloomsbury, in the county of Middlesex, "Improvements in electrical burglar alarms."—A communication to him from abroad by A. S. Howe, of Utica, State of New York, U.S.A.

3390. H. C. Mance, of 5, Magdala Terrace, Manor Road, Brockley, Kent, "Improvements in apparatus for telegraphing by means of reflected light."

3515. Sir David Lionel Salomons, Bart., of Broom Hill, Tunbridge Wells, "An improved electric communication between railway trains in transit or otherwise, and signals, stations, or termini, and in the apparatus employed therefor."

3533. P. Jensen, of 89, Chancery Lane, "Improvements in electric bell apparatus for signalling in hotels and other buildings and places."—A communication to him from abroad by Gustaf Adam Wiman, of Stockholm, Sweden.

A Scientific Practical Joke.—In a little work entitled "Recuerdos de Humboldt" (Recollections of Humboldt), the author, Dr. Aristides Rogas, relates what he terms *un incidente gracioso*, which happened to Humboldt at Calabozo. On approaching the llanos he was very anxious to obtain information about the electrical eels (*tembladores*) which abound in the rivers of the district. For this purpose he arranged to visit an eccentric student of electrical science, who before the appointed time contrived—with some ingenuity and great difficulty—to place one of the animals in question *en rapport* with the knocker on his study door. The servant, as desired by his master, directed the illustrious visitor to rap, and on his doing so a discharge of electricity took place, throwing him to the ground. The narrator goes on to state that Humboldt received his practical information as to the nature and amount of the electricity generated by the *tembladores* with all the equanimity of a philosopher in search of knowledge.

To Correspondents.

*** Duly authenticated contributions, theoretical and practical, on every subject identified with the interests of which "The Telegraphic Journal" is the organ, will always command attention. Anonymous correspondence will be wholly disregarded. Literary communications and books for review should be addressed to the Editor; business communications to the Publisher.